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- (30) Priority: 13.11.1996 FI 964548
- (71) Applicant: NOKIA MOBILE PHONES LTD. 02150 Espoo (FI)

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- (54) A system for limiting the transmitted power of a mobile communications means
- (57) The aim of the invention is to restrict the maximum transmitted power used by a mobile communication means. In most countries there are regulations in force which impose certain maximum limits on the power of electromagnetic radiation directed towards humans. These limits vary from country to country and will most probably be tightened in the future. In the system according to the invention, the upper limit of transmitted

power is varied according to the mode of usage of the mobile communication means. A mobile communication means according to such a system meets the requirements made on a device operating close to the user's head, but the same mobile communication means may still be used in applications demanding greater transmitted power in a situation where the power limits placed on the radio set are less strict.

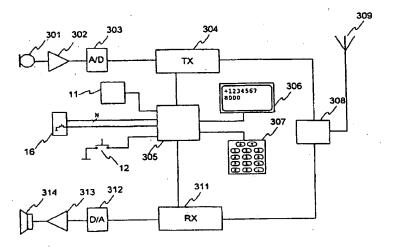


Fig. 3 Best Available Copy



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EUROPEAN SEARCH REPORT

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THOS SEARCH POLICE

Application Number

- EP 97 66 0122

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 97 66 0122

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power is varied according to the mode of usage of the mobile communication means. A mobile communication means according to such a system meets the requirements made on a device operating close to the user's head, but the same mobile communication means may still be used in applications demanding greater transmitted power in a situation where the power limits placed on the radio set are less strict.

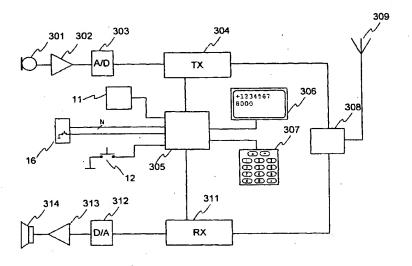


Fig. 3

Description ∴

an and called the mains a .. FIELD OF THE INVENTION

Section of the property of the property of the pro-.... This invention is aimed at limiting the maximum a 5 transmitted power-used, by, a mobile communication means, the completion of the demonstration ware despite to a partie emiliant. The responsibility and an effective transfer and the second

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- BACKGROUND OF THE INVENTION

In most countries there are regulations in force which place certain maximum limits on the power of electromagnetic radiation directed towards humans. These limits vary from country to country and will most probably be tightened in the future.

Service 12

On the other hand, as the transmission speed in mobile communication means systems increases, the amount of energy radiated by mobile communication means also increases. For example, in networks based upon TDMA technology, data transmission speeds may 20 in principle be increased by using several/successive time slots in the same TDMA frame, in which case the mean transmitted power increases. The use of several successive time slots in the same frame is possible in the Universal Mobile Telecommunication System (UMTS) under development and in new Global System for Mobile communications (GSM) standards which are a under development. In CMDA systems the transmitted power has to be raised in line with the data transmission speed if one wishes to keep the bit error rate constant. ...In both basic techniques the amount of energy radiated by the antenna increases as the data transmission speed increases, in which case the permitted limits may hat some stage be exceeded at a range a range both in

and directed towards the user is typically measured on the basis of the least favourable operating situation; in the case of a cordless telephone with the antenna almost pressed against the user's head. If a radio set may power, for example for voice transmission and for highspeed data transfer, all functions of the radio set have to adjust to the limits which follow from the least favourreable operating situation.

For example, in the current-GSM system, the max- 3: 45 imum power of a mobile communication means which is used during one time slot is 2 W, which means that the mean transmitted power is approximately:250 mW. According to new GSM standards which are being developed, a mobile communication means may use for the high-speed data transfer as many as all eight-time slots in one frame, in which case the mean transmitted power, is 2 W. This causes problems if the 250 mW which is satisfactory for voice calls has been set as the upper limit of radio power directed towards the user's head. In this situation the mobile communication means may not use maximum power levels, but must use instantaneous transmitted power lower than in a voice call, so that the

a limit of mean transmitted power is not exceeded. This again causes audibility problems, since the base stations in the mobile communication means network are designed to cope with the needs of a voice link.

SUMMARY OF THE INVENTION A ... indicate that recent the first in the last

The aim of this invention is to create a system which 1, adjusts the power level used by a mobile communication means to the mode of usage of the mobile communicastion means. A further aim of the invention is to create a system with the aid of which a mobile communication means may utilize the maximum permitted transmitted : power in any given situation. In addition, an aim of the 15; invention is to create a system with the aid of which the user may, if he so desires, limit the maximum values of electromagnetic radiation directed towards his body.

These aims are achieved by incorporating in the mobile communication means a device for identification of the mode of usage, and by arranging for the transmitited power of the mobile communication means to be limited according to the mode of usage and the type of current connection or connections.

Characteristic of the system according to the inven-25 tion is what is described in the characteristic part of the , independent claims. Dependent claims describe further to advantageous rembodiments of the invention. The invention is further directed to a mobile communication means; which is characterized by that which is de-30! scribed in the characterizing part of the corresponding independent claims of the state of the state of Total In the system according to the invention, the upper g limit of transmitted power used by the mobile communi-

*, cation means is varied according to the mode of usage. The radiation power caused by a particular radio set 35. A mobile communication means according to such a 3) system meets the more stringent requirements placed in upon sets which are to be used next to the user's head, but the same mobile communication means may still be ...employed for applications demanding greater transmits be used in many ways demanding differing transmitted is 40 to ted power in a situation where the power limits imposed te on the radio set are less strict.

When a mobile communication means is used in a a situation typical of a telephone; the mean power transmitted by the mobile communication means is limited to the maximum value for a telephone permitted by regulations and test procedures. When a mobile communication means is used for example as a data transfer device in conjunction with a portable computer, the maximum permissible transmitted power may be increased 50 in accordance with the requirements of the data transfer rate employed. 100 1 300

4 - 1 - 6 - 1 - 5 -SHORT DESCRIPTION OF THE DRAWINGS **

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the source of the Minister of the Property of the The invention will now be described in greater detail with reference to favourable embodiments, presented by way of example, and to the attached drawings, where

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represents one possible mechanism for identification of the mode of usage of a mobile communication means has used in the system according to the invention,

Figure 2

represents a second possible mechanism for identification of the mode of usage of a mobile communication means, as used in the system according to the invention, and Johnson Jacobson Elegan Massall (Marieta N. 9-10

Figure 3 an illustrates an advantageous embediment of A THE DISCHARGE WE and the invention. and the state of the 15.5 22 to 36 cont. 11

: In the drawings, the same reference numbers and symbols are used for parts which correspond to each others was wars library of above the and the section of the area of the

DETAILED DESCRIPTION OF THE PREFERRED INVENTION: A CHARAMBORD COMMON SERVER egat than commonwish regularities et

In the system according to the invention, the transmitted power of a mobile communication means is limited according to its operating situation. When the mobile communication means is used as a cordless telephone next to the user's head, the system restricts the transmitted power of the mobile communication means to the limits demanded by this situation. When the user connects the mobile communication means to a portable microcomputer, for the purpose of data transfer for power greater than in the preceding situation, in which case the mobile communication means may use transmission speeds higher than the transmission speed required for a talking connection, without impairment of the quality of the link: A mobile communication means? equipped with such a system is capable of adhering to differing transmitted power limits according to different operating situations, with the possibility however of using the high transmitted power required by high transmission speeds when it is both necessary and possible. 40

In the system according to this invention, several different methods may be employed for identification of the mode of usage of the mobile communication means, depending upon the design of the mobile communication/means to which the invention is applied.

.Some mobile communication means are openable, so that: when the mobile communication means is closed, the communication means acts as a cordless telephone, and when it is open the communication means acts, for example, as a portable computer and 6 50; multi-purpose communication means, which may be used for data transfer in many ways employing known technology. An example of this which may be mentioned is the GSM multi-purpose communication means, as presented, for example, on pages 57-58 of issue 31, " 1996, of Mobile Communications International. Figure 1 contains a particular solution according to the invention as applied to such a mobile communication means.

On different sides of a hinge 4 for connection of two openable parts 2, 3 of a mobile communication means are situated a switch 12 in a recess and a pin-10. When the mobile communication means is closed for normal 5 intelephone operation, the pin 10 presses against the reswitch 12. When the user opens the mobile communication means, the pin 10 releases the switch 12, so that the system according to the invention receives information concerning a change of mode of usage of the mobile communication means.

900 in The structure in Figure 1 is merely an example of a w possible solution. Monitoring of the cover position may, in the system according to the invention, be realized in many other ways familiar to men skilled in the art.

Mobile communication means are frequently used connected to a portable computer. Figure 2 shows one > particular method of detection of the mode in such a configuration. In Figure 2 a portable computer 20 is connected by means of a connection cable 18 to a mobile communication means 1. At the interface 16 of the mobile communication means 1 there is a pin 10, which is pressed down by the plug 14 of the connection cable 18 when the user inserts the plug 14 into the mobile communication means: The pin 10 may for example press against a mechanical switch so that the system is notiin fied of the change of mode. Connected to a portable computer, the mobile communication means is usually employed purely for data transfer, in which case the computer acts as a terminal, for example, with which the example, the system permits the use of transmitted " 30 I user links up to the computing system at his place of work. In such a stuation, high transmission speeds are u also an advantage. In such an application a system acproording to the invention permits the use of high transmitted power necessitated by the data transfer rates 3516 when the plug-1/4 is inserted into the connection socket 1016. When the connection cable 18 is not connected to id the mobile communication means 1, the system according to the invention only permits the use of transmitted Vispower de required Toral voice dallars and reasons locar

> an indentification of the mode of usage may also be Obased upon the use of a position switch or any other conventional position sensing device, in which case the evstem permits the use of high transmitted power when the mobile communication means is in the horizontal plane or sufficiently close to a horizontal position, for excample when it is purced on a table. The position switch ⊞ is to best advantage designed to recognize in particular when that side of the mobile communication means which is greatest in surface area is horizontal. With such an arrangement it is possible to avoid incorrect mode ridentification; for example in a situation where the user is speaking into the mobile communication means at the samé/time as leaning/backwards in an armchair:

Fig. In the mobile communication means there may be 550 a special pull-out alphanumeric keyboard for the entry to of text. In such a mobile communication means identification of the mode may be based upon the position of ... the keyboard: the system interprets the set as being in

telephone use when the keyboard is retracted within the set, and in data transfer use when the keyboard is pulled a**out**erfor e agras, trada est est esta e

end In a system according to this invention, restriction of the mean transmitted power being used may be effected in a number of different ways. In time division mobile communication means systems, the mean transmitted power may be reduced by decreasing the number of time slots transmitted in one frame, in which case the data transmission speed drops. The mean transmitted 10 . The system according to the invention may furtherpower may also be reduced by decreasing the instantaneous power used during one time slot, in which case the number of time slots to be transmitted may be kept constant. The first to the first to the second of the seco

was Limitation of the transmitted power may to best advantage be effected according to the operating situation: For example, if the mobile communication means is transmitting a file from its memory at a high data transfer rate using several time slots precisely when the user -switches the telephone to a mode in which the set is \sim 20 $_{\odot}$ used principally as a telephone, the method for limitation of transmitted power which is employed may be chosen on the basis of the type of data transmission connection. If the transmission connection used permits a change in the transmission speed, the system reduces the -inumber of time slots used. If the transmission connection does not permit a change in the transmission speed, the number of time slots used must be kept constant, in which case the transmitted power used during one time slot must be reduced, in conditions of good audibility this if 30 largest one frame, the largest state of the conditions of good audibility this if 30 largest one frame, the largest state of the conditions of good audibility this if 30 largest one frame, the largest state of the conditions of good audibility this if 30 largest one frame, the largest state of the conditions of good audibility this if 30 largest one frame, the largest state of the conditions of good audibility this is 30 largest one frame. is not a problem, but reduction of transmitted power at the margins of the area covered by the base station may cause an increase in bit error probability or interruption of the connection. The Political Place is a substaint

The Power transmitted in CDMA systems may be re-20 35 the occease in the transmitted power used in data trans-"duced either by lowering the data transmission speed, are in which case the quantity of energy transmitted by the mobile communication means falls loo by keeping the data transmission speed the same but reducing the transmitted power, for example by decreasing the trans-· mitter's output stage amplification, in which case the bit error rate of the connection increases. The choice of the best procedure thus depends upon the quality of the connection in the CDMA system upon the data transconnection.

Owing to the various effects of the different ways of limiting transmitted power as described above, the user may to his advantage determine in advance the type of power limiting method which the mobile communication means should use in the first place. The user may, for example, decide that the mobile communication means should in the first place reduce the number of time slots used, in which case the connection will be maintained more securely, and that the power used during one time slot should be reduced only when some other type of function is not possible.

In the system according to this invention, the max-

: imum power limit observed by the system when the mobile communication means is used as a telephone may be set on manufacture of the mobile communication means on the basis of test/measurements carried out on samples. Owing to changes in the limits set by the authorities and to the differing regulations in different countries, it is an advantage if the said power limit can be changed at a later stage either by the retailer or by in the user of the mobile communication means.

more restrict the modes of usage of the mobile commu-.. nication means when the mobile communication means uses a high transmitted power. The system may, for example, totally prevent use of the mobile communication 15 means as a telephone, or permit only calls made with the aid of the hands-free function. With such an arrangement it is possible to affect the user in such a way that he does not use the mobile communication means in a

situation in which the mobile communication means exceeds the limits according to issued regulations. The system according to the invention may thus restrict the function of the mobile communication means win addition to limiting of the transmitted power, by restricting the mode of usage. The system may then react to a change in mode when a high data transmission

speed and a high transmitted power are in use, for exi. ample in the following three ways: with a district the things of their

by reducing the number of time slots used during

 $\omega = \omega^{\prime}$ if this is not possible on account of the transmission ar an mode used, by reducing the power used during one time slot, or sending the line of the second and

by preventing the making of a normal call, if a deescapitation interrupt the transmission connection. MACHER STREET

ELECTIONS OF GIVEN STREET BY A STREET 11/2 to Fig. 3 shows a block diagram of a digital mobile communication means according to an advantageous embodiment of the invention. The mobile communication means comprises a microphone 301, keyboard 307, : Idisplay 306, earpiece 314, antenna duplexer or switch · 308, antenna 309 and a control unit 305, which all are mission speed and upon the quality of the transmission 45 typical components of conventional mobile communication means. Further, the mobile communication means contains typical transmission and receiver blocks 311, a 304. Transmission block 311 comprises functionality necessary for speech and channel coding, encryption, and modulation, and the necessary RF circuitry for am-50· plification of the signal for transmission. Receiver, block 304 comprises the necessary amplifier circuits and functionality necessary for demodulating and decryption of the signal, and removing channel and speech coding. The signal produced by the microphone 301 is amplified 55 in the amplifier stage 302 and converted to digital form

in the A/D converter 304, whereafter the the signal is

taken to the transmitter block 304. The transmitter block

encodes the digital signal and produces the modulated and amplified kF-signal, whereafter the RF signal is taken to the antenna 309 via the duplexer or switch 308. The receiver block 311 demodulates the received signal and removes the encryption and channel coding. The resulting speech signal is converted to analog form in the D/A converter 312, the output signal of which is amplified in the amplifier stage 313, whereafter the amplified signal is taken to the earpiece 314. The control unit 305 controls the functions of the mobile communication means, reads the commands given by the user via the keypad 307 and displays messages to the user via the display 307. Further, the control unit communicates with external devices via the connection socket 16 and monitors the state of the switch inside the communication socket 16 as well as other switches 12 indicating the mode of usage of the communication means. The control unit may also monitor the output signal of a position sensing device 11. The control unit then controls the transmitting power of the communication means and/or allows and/or restricts the mode of usage of the communication means in the ways described previously. When performing such control, the control unit may take also into account the types of the connections active at that time. For example, if one of the connections is for communication of speech and the mobile communication means is not in a hands-free mode, the control unit may limit the transmitting power. As a further example, if the mobile communication means is in a hands-free mode, the control unit may allow any necessary transmission mode and power to be used, since the user will most likely not have the mobile communication means close to his/her body in such a situation to the

The present invention is not limited to the embodiment of Fights, which is presented as an example only. 35-For example, the invention can as well be applied to an analog communication means.

With the aid of the system according to the invention the mobile communication means user may limit the

'A mobile communication means utilizing the system according to the invention may be employed both as a cordless telephone and as a high-speed data transfer device and in both operating situations it may use the maximum mean transmitted power permitted in the op-31 45% at connected to said connector. erating/situation/in question.

The invention has been explained above with reference to certain favourable applications thereof, but it is clear that the invention may be varied in many different ways within the framework of the innovative concept de-fined in the attached:Patent Claims. (a) 100 (a) applica

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Addition Cation of Experie

1.64 A system for limiting the transmitted power of a mobile communication means capable of having at least one connection having a connection type,

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at least one means for producing an indication notion to of the mode of usage of the mobile communi-5 Holed to acation means, choose spirate to people of the -control unit for controlling the functions of the -linears and for control-Today of the transmitting power of the mobile com- If a response to said means 10 1. 10 10 for identification and the connection type of the to the serial least one connection. Burn March March 1988 AFRICADOR N. A. ٠., ٠

- 2. A system according to claim 1, characterized in that it is arranged to limit the instantaneous transsamitted power as a response to said means for identification and the connection type of the at least one connection. 1145 Ç. 4 aistrip diffusyr men. 🗥 . 1 1 - . 1
- 3. A system-according to claim 1, characterized in 20 that it is arranged to limit the data transmission is speed used by the mobile communication means as a response to said means for identification and the the connection type of the at least one connection. gravity prepared on lover the contract of the second state of
- 25 2 4. 8/ At system-according to claim 1, characterized in et sandhat it is arranged to limit the number of time slots be a used for transmission in one frame of the time diviin the sion system as a response to said means for identification and the connection type of the at least one 30 of the Connection, he have the contraction of the con-

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- 7: 51: A system according to claim 1, characterized in about that it is arranged to prevent high-speed data transmission in a situation where the mobile communiad cation means would exceed the permitted power The realimits on the tuse of high-speed data transmission யர் yd astarresponse to:said means for identification and or the connection type of the at least one connection. disk back in contracted the same but reducing the
- amount of radiation directed towards his body. ethers 1994 40 at 6.44 Adsystem according to a laim 1, echaracter zed, in this sit that it comprises a connector for connecting an exand to sternal cable, and in which system at least one of with the said at least one means for producing an indication shed, is a switch indicating whether or not there is a cable
 - : 7: A system according to claim, 1, characterized in nthat it comprises a first part, a second part, and at and a least one hinge for rotatably attaching said first part to said second part, and in which system at least one of said at least one means for producing an indication is a means for producing an indication of the relative position of said first and second parts of the mobile communication means.

ica a

55, You grade the construction 8. A system according to claim 1, characterized in that at least one of said at least one means for producing an indication is a position sensing device.

- A mobile communication means capable of having at least one connection having a connection type, characterized in that it comprises
 - at least one means for producing an indication of the mode of usage of the mobile communication means,
 - a control unit for controlling the functions of the mobile communication means and for controlling the transmitting power of the mobile communication means as a response to said means for identification and the connection type of the at least one connection.

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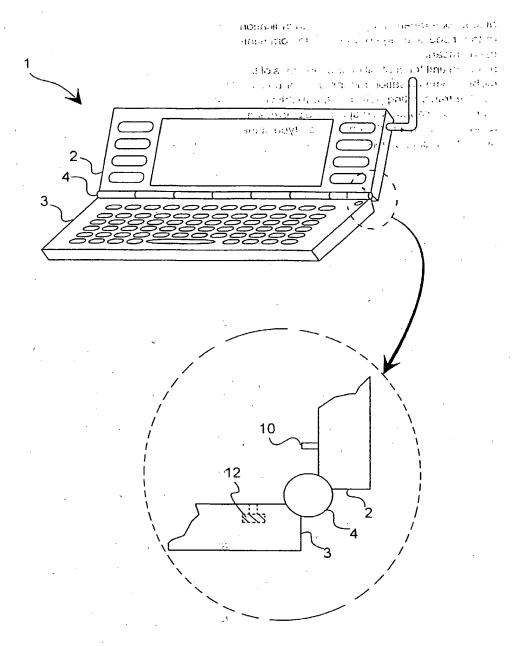


Fig. 1

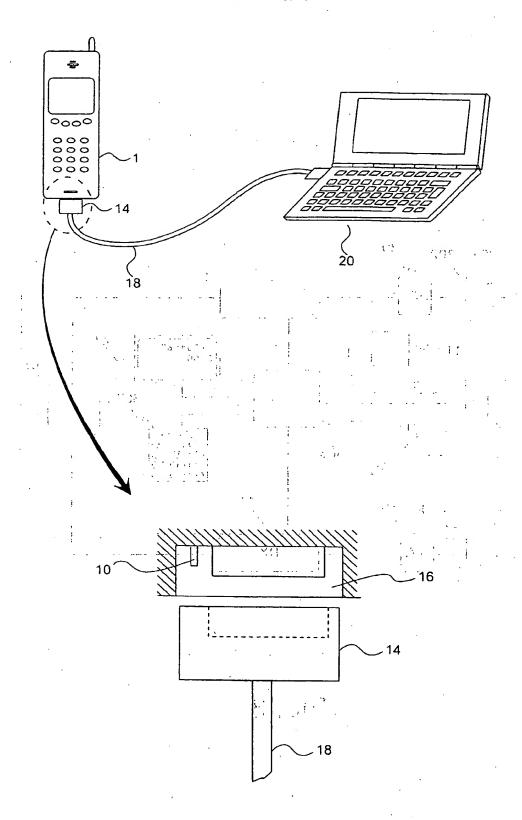


Fig. 2

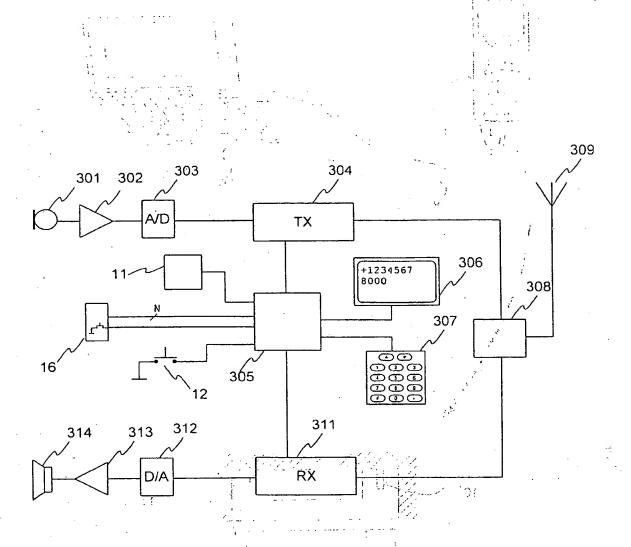


Fig. 3

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(51) Int Cl.7: **H04B 7/005**, H04Q 7/32

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(71) Applicant: NOKIA MOBILE PHONES LTD. 02150 Espoo (FI)

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 Ojanperä, Tero 00200 Helsinki (FI)

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(54) A system for limiting the transmitted power of a mobile communications means

(57) The aim of the invention is to restrict the maximum transmitted power used by a mobile communication means. In most countries there are regulations in force which impose certain maximum limits on the power of electromagnetic radiation directed towards humans. These limits vary from country to country and will most probably be tightened in the future. In the system according to the invention, the upper limit of transmitted

power is varied according to the mode of usage of the mobile communication means. A mobile communication means according to such a system meets the requirements made on a device operating close to the user's head, but the same mobile communication means may still be used in applications demanding greater transmitted power in a situation where the power limits placed on the radio set are less strict.

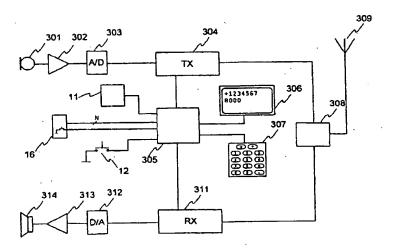


Fig. 3



EUROPEAN SEARCH REPORT

Application Number

EP 97 66 0122

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